Personnel Safety System Generation-3 Review April 27, 2004

Morning Session

Presented by

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Gen-3 Prototype Implementation at 30-ID

Roy Emerson

Generation-3 Prototype Implementation

- **Install Prototype Test Bed system Experimental Floor at 30-ID**
  - Standard PSS field device installation by 4th week of May.
    - *Install field devices for 3 beamline stations (Technicians)*
      - Search Boxes
      - Crash Buttons
      - Emergency Egress
      - Speaker and Strobe lights
      - Pneumatic Door Control Boxes
      - Magnetic Door Locks
      - Electronic and mechanical Door Closed switches
      - Cables for BL-EPS
      - Install mezzanine cabinet components

Generation-3 Prototype Implementation

- Installation of Generation-3 PSS completed by the 3rd week of June
  - *Receive and install Mezzanine Circuit boards – Technicians.*
  - *Terminate Mezzanine field wiring – Technicians.*
  - *Complete installation of mezzanine cabinet components – Technicians.*
  - *Receive and install (3) station Circuit boards – Technicians.*
  - *Terminate station field wiring – Technicians.*
- Checkout installation 4th week of June
  - *Wiring check – Technicians.*
  - *Initial Power to equipment – Technicians.*
  - *Unofficial I/O check – Technicians and programmers.*
  - *Hardware and Wiring Debug– Technicians and programmers.*

Generation-3 Prototype Implementation

- Finalize 30-ID Validation procedure 1st week of July
  - *Specific to beamline configuration at the time.*
- Validate Generation-3 PSS 2nd week of July
  - *Debug and evaluate software for proper functionality.*
  - *Correct any software errors and revalidate system.*
- Operate beamline in test mode until 2nd week of August
  - *Validation System Test carts will remain attached to beamline operating in simulation mode to simulate shutters (There will be no shutters until September at the earliest).*
  - *SI personnel will operate the beamline using a written plan twice a day recording and reporting any observed anomalies as well as proper system behavior.*

Generation-3 Prototype Implementation

- Generation-3 System Training 1st week of August
  - *Train the floor coordinators and the users on beamline operation with the Touch Screen user interface.*
  - *Train the floor coordinators and SI Group call-in staff on minimal trouble shooting enabling them to assist the SI Group in the same manner they do for all other beamlines.*
- Operational readiness review 2nd week of August
  - *Correct any noted deficiencies.*
- Turn beamline over to the users.

Gen-3 Prototype Implementation at 30-ID

QUESTIONS?

Training

Greg Markovich

Generation-3 Training

- **Groups Requiring Training**
  - Safety Interlocks Group
  - Floor Coordinators EFO Group
  - Main Control Room Operators
  - Users

Generation-3 Training

- **Our Needs**
  - Everyone in SI Group
    - *Training on what is different from generation-1 to Generation-3.*
    - *General overview of how it all fits together.*
    - *Beamline operation using Touch Screens.*
    - *How to access local diagnostics on the Touch Screen.*
    - *How to access help on the Touch Screens.*
    - *Identification and meaning of programmed system faults.*

Generation-3 Training

- **Our Needs**
  - Everyone in SI Group
    - *Accessing the local alarm screens to identify fault cause.*
    - *Where to find the current system documentation.*
    - *Trouble shooting issues*
      - Identify key system test points for:
        - Power distribution.
        - Signal and power ground references.
        - Global On-line (in test mode or not).
        - System watch dog circuits.

Generation-3 Training

- **Our Needs**
  - Technicians in SI Group
    - *Installation issues*
      - Drawing review highlighting the key areas field devices will terminate on the new circuit boards.
      - Termination concerns avoiding excessive strain at termination points.
      - Workmanship quality expectations.
      - Best training of all…….hands on.

Generation-3 Training

- **Our Needs**
  - Technicians in SI Group
    - *Installation issues (cont.)*
      - Field devices are the same and will connect with the same cables in most cases at the device.
      - The main exception will be shutters
        - Shutter relays have been relocated to the circuit board.
        - The external shutter electrical box will only contain. terminals to connect to the shutter limit switches, pressure switches and solenoids.
        - The pressure switches and solenoids will remain in the shutter pneumatic box and are the responsibility of the vacuum group.

Generation-3 Training

- **Our Needs**
  - New Testing Methods for Validation Teams from SI Group
    - *New validation procedures.*
    - *How to use the Validation System test cart.*
    - *Validation System cart connections and procedure.*
    - *The system must be Global Off-Line before accessing any test connection.*

Generation-3 Training

- **Floor Coordinators**
  - Training on what is different from generation-1 to Generation-3.
  - General overview of how it all fits together.
  - Operating the beamline using the Touch Screens.
  - How to identify missing interlocks for Beam Ready status.
  - Identification and meaning of programmed system faults.
  - Accessing system help.
  - Validations.

- **MCR Operators**
  - Access to EPICS screens.
  - Interpretation of screen indicators.

Generation-3 Training

- **Beamline Users Needs**
  - Operating the beamline using the Touch Screens.
  - How to identify missing interlocks for Beam Ready status.
  - Identification and meaning of programmed system faults.
  - Accessing system help.

- **How to Best Use the new capabilities**
  - EPICS access to the system
    - *How to obtain System Status.*
    - *Remote access to Shutter control (Interlocks must be satisfied)*
      - Close will always override open.
      - Local control will override remote control.
    - *Assistance is available for the EPICS interface for any user wanting to automate shutter control.*

Generation-3 Training

QUESTIONS?

Outline of Approvals & Processes

Roy Emerson

PSS Generation-3 Process & Approvals

- **Discussions were started about a Generation-3 PSS**
  - Weekly meetings were held with the primary focus on three issues.
  - What do we have to change.
  - What do we want to change.
  - How will we design it to allow for complete function testing, with the effort and disruption required by the tests kept within reasonable limits. (G BISS 3h).
- **March 2003 - Generation-3 presentation at CAT TWG**
  - Meeting to solicit user input in an open forum.
- **Develop the design**
  - Develop three different architectural designs.
  - Meet with hardware vendors – request quotes.
  - Develop a rudimentary bill of materials for design comparison.

PSS Generation-3 Process & Approvals

- **April 2003 - System architecture review**
  - Review committee composed of:
    - *Critical Component System Manager – Committee Chair.*
    - *PSS Deputy Group Leader.*
    - *PSS System Manager.*
    - *Access Control & Interlock Systems - System Manager.*
    - *Externally Funded User (Physicist).*
    - *ASD Controls Group Specialist.*
    - *External Consultant (Former Accelerator Division Director).*

PSS Generation-3 Process & Approvals

- Review Committee Charge
  - *Should we migrate from Generation-1 to Generation-3?*
  - *Is the focus on the right issues?*
  - *Assess the technical options for Generation-3.*
  - *Provide feedback and guidance on how to move foreword.*
  - *Provide feedback and guidance on any other pertinent issues.*

➢ **May 2003 - Review committee approval of System architecture**
  - *The committee felt moving to a 3 chain system has its advantages.*
  - *The committee strongly suggested the EPICS interface be extensive and present from installation.*
  - *The committee had no preference for the user interface Touch Screen technology (Panel View Plus vs. OEM Touch Screen running Wonderware).*

PSS Generation-3 Process & Approvals

- *The committee pointed out the APS SAD clearly has taken credit for different hardware vendors for the two Emergency Shut Down chains (Diversity). The committee felt additional discussion should take place.*
- *The committee noted adequate testing should be performed before turning the system over to the users. The committee did not define adequate.*
- *The committee pointed out the new system can be installed at sector 30-ID the ISX beamline as a test bed with the advantage that the beamline is funded by BES and managed internally by APS members. This beamline is not expected to receive beam until September 2004.*
- *The committee unanimously preferred using PLCs for all three chains as opposed to using an industrial computer for Chain-C.*

PSS Generation-3 Process & Approvals

- **Develop a Statement of Work**
  - Develop a system block diagram.
  - Identify project goals.
  - Identify project deliverables.
  - Identify team members responsibilities.
  - Define a proposed schedule.
- **June 2003 - Release (SOW) Statement of Work**
  - Develop a design and test methodology that will allow Non-Invasive testing while remaining failsafe and provide the infrastructure for future automated system validations.
  - Meet with additional hardware vendors.

PSS Generation-3 Process & Approvals

- **August 2003 - Non-Invasive Testing Technology review**
  - Review committee composed of:
    - *Critical Component System Manager – Committee Chair.*
    - *Safety APS Operations Division.*
    - *Access Control & Interlock Systems - System Manager.*
    - *APS Site Physicist.*
    - *In-house User (Physicist).*
    - *Externally Funded User (Physicist).*
    - *External Consultant (Former Accelerator Division Director).*
  - Review Committee Charge
    - *Are the designers in the right track in their approach for the new methodology for a non-invasive testing of the next generation PSS system?*

PSS Generation-3 Process & Approvals

- **September 2003 - Approval to use Non-Invasive Testing Technology**
  - The committee clearly recognizes the need for improvement and more efficient testing of the PSS system.
  - To quote the committee “The proposed method of automatically sensing the presence of the test system is the right approach. The deviation from the current philosophy of physically disconnecting connector wires is clearly a correct approach. The methodology of designing the PSS system with provision for attaching simulators for testing, and the PSS system to sense it and properly disable the systems is the right approach.”
  - The committee strongly urges the reduction of the number of administrative processes.
  - The committee cautioned the designers to insure the final testing includes end-to-end trip testing of the Front End Shutters as they are simulated during validation.

PSS Generation-3 Process & Approvals

- The committee expressed a concern for nuisance failures with the method of disconnecting the critical outputs. The method uses relays that are always energized except when testing. While they acknowledge the approach is failsafe they are concerned for reliability.
- As a final remark the committee suggested using the relays proposed in the previous paragraph or a keyed switch to disconnect the critical outputs to the Front End Shutters. The committee did express a preference for the relays as they eliminate another administratively controlled procedure.

PSS Generation-3 Process & Approvals

- **October 2003 - Materials and Cost Estimates**
  - Develop detailed bill-of-materials for budgeting.
- **October 2003 - Project Budget Established**
  - Request demo hardware/software for evaluation form Allen-Bradley and GE.
  - Continue development of preliminary documents
    - *System and User requirements.*
    - *System Master Fault lists (3) etc.*

PSS Generation-3 Process & Approvals

- **November 2003 - Issues - Station access when shutters closed**
  - Safety Considerations of station access – redesign fault handling and door/shutter interlocks with internal group approval and agreed criteria to allow door opening. This had a major ripple effect on all interlocks.
  - Continue to Refine documents
    - *PSS I/O lists (3).*
    - *Lab Simulator I/O Lists.*
    - *Validation Test System I/O lists.*

PSS Generation-3 Process & Approvals

- **January 2004 - System design and Requirements Developed**
  - Prepare the System Requirements Document and start review.
  - Prepare the System Functional Description and start review.
  - Refine details of circuit board design.
  - A surprise
    - *We will have a Front End Shutter Interface Enclosure (FESIE) (Start Integration).*

PSS Generation-3 Process & Approvals

- **February 2004 - Chain-C Kirk Keys approved by RSPC**
  - A relocation of mode shutter locking key from ESD Chain-A to Chain-C.
  - A last minute addition the Mezzanine PSS Test Chassis (MPTC).
  - Develop the mezzanine circuit board with extensive review and refinement cycles.
  - Sign off the mezzanine circuit board for construction.
  - Send mezzanine circuit board schematics out for board layout.

PSS Generation-3 Process & Approvals

- **March 2004 - All documents assigned to DCC numbers**
  - Complete many documents in various stages of development.
  - Circulate documents for internal review.
  - Receive mezzanine circuit board preliminary layout for review.
- **March 2004 - Internal status review**
  - Develop the station circuit board with extensive review and refinement cycles.
  - Sign off the station circuit board for construction.
  - Send station circuit board schematics out for board layout.
  - Eliminate a Touch Screen vendor (software installation problems not rectified after 3 weeks).
- **April 2004 - External status review of the Generation-3 System and Process**
  - That is why we are here today.

PSS Generation-3 Process & Approvals

- **March 2004 - All documents assigned to DCC numbers**
  - Complete many documents in various stages of development.
  - Circulate documents for internal review.
  - Receive mezzanine circuit board preliminary layout for review.
- **March 2004 - Internal status review**
  - Review committee composed of:
    - *Critical Component System Manager.*
    - *Electrical Systems Associate Division Director.*
    - *Mechanical Systems Associate Division Director.*
    - *ASD Quality Control.*
  - Presented to the reviewers
    - *30 Minute Generation-3 Update (open to all interested).*
    - *Review of SOW deliverables and Project schedule.*

PSS Generation-3 Process & Approvals

- Review Committee observations
  - *Completion of all documentation for the April review will be difficult but doable.*
  - *Crucial to meeting the present schedule is timely completion of the lab simulator for software development.*
  - *The lab simulator must be rescheduled do to a conflict with shut down work requiring technicians.*
  - *The schedule must be adjusted.*
  - *The committee noted 10 action items at this time that are important to the successful completion of the project.*
- The project team will address each of the items as part of the necessary tasks to complete the project.

PSS Generation-3 Process & Approvals

- Develop the station circuit board with extensive review and refinement cycles.
- Sign off the station circuit board for construction.
- Send station circuit board schematics out for board layout.
- Eliminate a Touch Screen vendor (software installation problems not rectified after 3 weeks).

➢ **April 2004 - External status review of the Generation-3 System and Process**

- That is why we are here today.
- Correct any Issues.
- Circulate to the review committee for approval.
- Circulate Generation-3 documents for final review and approval.

➢ **Start building lab simulator 1st week of May**

- Simulator construction can progress with staff if no objections.

Outline of Approvals & Processes

QUESTIONS?

The Standard Builds Package

Greg Markovich

Standard Build Package

- **What is it?**

  - Approved, validated and accepted prototype PSS Generation-3.

    - *Documentation*
      - USER requirements, PLC I/O lists, drawing set for fabrication and installation of PSS hardware and validation procedures, etc.
    - *Schedules*
      - Procurement, fabrication, installation, checkout.
    - *Hardware*
      - Procurement, installation.
    - *Training*

Standard Build Package

- **And how long will installation take**
  - Typically two weeks per station to connect and debug station PSS field devices.

Standard Build Package

- **Prototype to Accepted Gen-3 Implementation Schedule**
  - August – S30 Gen-3 prototype is operational.
  - August –September shutdown
    - *Shutters installed.*
    - *Staff will be operating system as if it is a functioning beamline.*
    - *Gaining experience.*
  - 1700 Hrs of operation (with FE simulator)
    - *Daily SI Group interaction.*
    - *Training opportunity.*
    - *User interaction.*
  - User accepts prototype Gen-3.
  - OFFICIAL GEN-3.

The Standard Builds Package

QUESTIONS?

Thank You

Review committee draft report.

Thank You

Close-out